


<b>VOLVO PENTA</b> TAD1670VE	Document No	Issue Index
	<b>22293860</b>	<b>10</b>

## Important

This Technical Data Sheet and the corresponding Installation Instructions provide important information to ensure the installed engine will operate according to the design specification in the Volvo Penta application for certification.

Requirements marked with  are considered as critical for exhaust emissions compliance according to the design specification in the Volvo Penta application for certification.

Failing to follow and meet these instructions and requirements when installing a certified engine in a piece of nonroad equipment for use in the United States violates U.S. federal law (40 CFR 1068.105(b)), subject to fines or other penalties as described in the Clean Air Act.

## General

In-line four stroke diesel engine with direct injection. Rotation direction, counterclockwise viewed towards flywheel

Number of cylinders			6
Displacement, total	liters		16,12
	in <sup>3</sup>		984
Firing order			1-5-3-6-2-4
Bore	mm		144
	in		5,67
Stroke	mm		165
	in		6,50
Compression ratio			17,0:1
Wet weight	Engine only (Estimated) (excl after treatment comp.)	kg	1565
		lb	3450
	Power pac	kg	
		lb	

## Performance

				rpm	1200	1500	1800	1900
IFN Power	405 kW	without fan		kW	339	405	405	405
				hp	461	551	551	551
		with fan		kW	See diagram for fan power consumption			
		890 mm		hp				
Torque at:	IFN Power			Nm	2698	2578	2149	2036
				lbf ft	1990	1902	1585	1501
Max torque at engine speed		rpm	1260 rpm	Nm	2750			
				lbf ft	2028			
Power tolerance				%	±2			
Mean piston speed				m/s	6,6	8,3	9,9	10,5
				ft/sec	21,7	27,1	32,5	34,3
Effective mean pressure at:	IFN Power			MPa	2,10	2,01	1,67	1,59
				psi	305	291	243	230
Max combustion pressure at:	IFN Power			MPa	15	15	16	16
				psi	2175	2175	2320	2320
Total mass moment of inertia, J (mR <sup>2</sup> ) (not including flywheel)				kgm <sup>2</sup>	4,1			
				lbft <sup>2</sup>	97,3			
Friction Power				kW	26	39	58	65
					hp	35	53	79

**Derating see Technical Diagrams**

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<b>Engine brake performance (only engines with VCB)</b>		<b>rpm</b>	<b>1200</b>	<b>1500</b>	<b>1900</b>	<b>2200</b>
Brake power:	without fan	kW	85	152	284	345
		hp	116	207	386	469
Brake torque:	without fan	Nm	676	968	1427	1498
		lbf ft	499	714	1053	1104
Engine speed range for VCB activation:		rpm	1000-2200			
Min engine speed with VCB still active:		rpm	900			
Min oil temperature for VCB activation:		°C	55			

### Cold start performance

*Cold start limit temperature	without starting aid	°C	-10		
		°F	14		
	#REF!	°C	-25		
		°F	-13		
	#REF!	°C	-30		
		°F	-22		
*Specify oil and fuel quality	T>-15°C Oil VDS4/VDS3 15W/40 T<-15°C Oil VDS4/VDS3 5W/40				
Heater type	Make	Power kW	Engaged hours	Cooling water temp engine block	
Self circulating	Volvo 21578298	2	12	1°C 34°F	

\* See also general section in the sales guide

### Lubrication system

Lubricating oil consumption at max rpm at:	IFN Power	liter/h	0,03
		US gal/h	0,008
Oil system capacity including filters	liter	48	
	US gal	12,68	
Oil pan capacity: (both variants)	Max	liter	42
		US gal	11,10
	Min	liter	32
		US gal	8,45
Oil change intervals/specifications	VDS3	h	1000 / See manual
	VDS4	h	1000 / See manual
Engine angularity limits:	front up	°	30
	front down	°	30
	side tilt	°	30
Oil pressure at rated speed	kPa	300 - 650	
	psi	44 - 94	

### Lubrication system




Lubrication oil temperature in pan:	max	°C	130
		°F	266
Oil filter micron size		μ	40

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### Fuel system

System supply flow at max. Speed	liter/h	165
	US gal/h	43,6
Fuel supply line max. restriction (measured at fuel inlet connection)	kPa	10
	psi	1,5
Fuel supply line max. pressure, during engine stand still (measured at fuel inlet connection)	kPa	16,5
	psi	2,4
Max system return flow	liter/h	30,0
	US gal/h	7,9
Fuel return line max. restriction (measured at fuel return connection)	kPa	20
	psi	2,9
Max. allowable inlet fuel temp (Measured at fuel inlet connection)	°C	60
	°F	140
Prefilter / Water separator micron size	μ	10
Fuel filter micron size	μ	5
Engine Control System, standard	Volvo/EMS2.3	
Specific UREA consumption, NRTC	Vol%	5,6
Fuel to conform to	Fuel equal to or better than EN590:2009 or ASTM D975-09 and Max sulphur 15ppm	



### Intake and exhaust system

		rpm	1200	1500	1800	1900
Change air consumption at: (+25°C and 100kPa)	IFN Power	m³/min	24,9	30,1	32,7	33,9
		cfm	879	1063	1155	1197
 <b>See front page for important information</b>						
Max allowable air intake restriction including piping		kPa psi	6 0,9			
Heat rejection to exhaust at:	IFN Power	kW	241	297	304	312
		BTU/min	13705	16890	17288	17743
Exhaust gas temperature after turbine at:	IFN Power	°C	455	480	465	465
		°F	851	896	869	869
 <b>See front page for important information</b>						
Max allowable back pressure in exhaust line (after turbine)		kPa	18	24	28	29
Pipe dimension Ø: 125 mm		psi	2,6	3,5	4,1	4,2
 <b>See front page for important information</b>						
Max allowable temperature drop between turbine and SCR muffler inlet.		Δ°C Δ°F	10 18	10 18	10 18	10 18
SCR muffler pressure drop (at exhaust gas flow and exhaust temp given)		kPa psi	16 2,3	22 3,2	24 3,5	25 3,6
Exhaust gas flow at: (temp and pressure after turbine at the corresponding power setting)	IFN Power	m³/min	63,0	78,0	81	83
		cfm	2225	2755	2861	2931

**Cooling system**

			<b>rpm</b>	<b>1200</b>	<b>1500</b>	<b>1800</b>	<b>1900</b>
Heat rejection radiation from engine at:	IFN Power	kW	7	7	7	7	
		BTU/min	398	398	398	398	
Heat rejection to coolant at:	IFN Power	kW	134	158	170	177	
		BTU/min	7620	8985	9668	10066	
Coolant		Volvo Penta coolant "ready mix" or Volvo Penta coolant mixed with clean fresh water 40 / 60					
Radiator cooling system type		Closed circuit					
Standard radiator core area	IFN/ICFN Power	m <sup>2</sup>	1,42				
		foot <sup>2</sup>	15,28				
HD radiator core area		m <sup>2</sup>	0,87				
		foot <sup>2</sup>	9,36				
Fan diameter	890 mm	IFN/ICFN Power	mm	890			
			in	35,04			
Fan power consumption	890 mm	kW hp	See diagram for actual fan drive ratio power.				
Fan drive ratio	fan Ø890		See diagram for cooling performance				
Coolant capacity:	Engine	liter	24				
		US gal	6,3				
	STD. 1,42m <sup>2</sup> radiator with hoses Pusher syst. Core thickness 63mm	liter	37				
		US gal	9,8				
	STD.1,42m <sup>2</sup> radiator with hoses Puller syst. Core thickness 41mm	liter	30				
		US gal	7,9				
HD 0,87m <sup>2</sup> radiator with hoses	liter	32					
	US gal	8,5					
Coolant pump		drive/ratio	belt/1,77:1				
Coolant flow with standard system		l/s	4,7	5,8	7	7,3	
		US gal/s	1,2	1,5	1,8	1,9	
Minimum coolant flow		l/s	4,3	5,4	6,6	6,9	
		US gal/s	1,1	1,4	1,7	1,8	
Maximum outer circuit restriction incl. piping		kPa	70,0				
		psi	10,2				
Thermostat:	start to open	°C	82				
		°F	180				
	fully open	°C	92				
		°F	198				
Maximum static pressure head (expansion tank height + pressure cap setting)		kPa	100				
		psi	14,5				
Minimum static pressure head (expansion tank height + pressure cap setting)		kPa	70				
		psi	10,2				
Standard pressure cap setting		kPa	75				
		psi	10,9				
Maximum top tank temperature		°C	107				
		°F	225				
Recommended Draw down capacity. The difference between min coolant level in the expansion tank and the lowest level where the engine's coolant system still are functioning		liter	2				
		US gal	0,5				

**Charge air cooler system**

		rpm	1200	1500	1800	1900
Heat rejection to charge air cooler	IFN Power	kW	58	86	86	90
		BTU/min	3298	4891	4891	5118
Charge air mass flow	IFN Power	kg/s	0,49	0,58	0,62	0,65
Charge air inlet temp. (Charge air temp after turbo compressor)	IFN Power	°C	161	164	165	166
		°F	322	327	329	331
 <b>See front page for important information</b> Max allowable Charge air outlet temp. (Charge air temp after charge air cooler)		°C	40	45	50	50
		°F	104	113	122	122
 <b>See front page for important information</b> Maximum pressure drop over charge air cooler incl. piping		kPa	13			
		psi	1,89			
Charge air pressure (After charge air cooler)		kPa	190	185	163	163
		psi	27,56	26,83	23,64	23,64
Standard charge air cooler core area		m <sup>2</sup>	1,3			
		foot <sup>2</sup>	13,99			

**Cooling performance: STD cooling package 1,42m<sup>2</sup> radiator and suction 890mm fan**

Cooling air flow and maximum additional external restriction at different radiator air temperatures based on 107°C TTT and 40% coolant. Valid at 1 atm.

**Fix fan drive ratio 1:0,88**

Engine speed rpm	Engine power kW hp	Air on temp		Air flow		External restriction	
		°C	°F	m <sup>3</sup> /s	ft <sup>3</sup> /s	Pa	psi
1900	405 551	45	113	6	211,9	740	0,107
		50	122	6,7	236,6	590	0,086
		55	131	7,6	268,4	400	0,058
		60	140	8,6	303,7	180	0,026
		63	145	9,4	332,0	80	0,012
		65	149	10,1	356,7	0	

**Cooling performance: STD cooling package 1,42 m<sup>2</sup> radiator and pusher 890mm fan**

Cooling air flow and maximum additional external restriction at different radiator air temperatures based on 107°C TTT and 40% coolant. Valid at 1 atm.

**Fix fan drive ratio 1:1,13**

Engine speed rpm	Engine power kW hp	Air on temp		Air flow		External restriction	
		°C	°F	m <sup>3</sup> /s	ft <sup>3</sup> /s	Pa	psi
1900	405 551	72	161	10,0	353,1	450	0,065
		73	164	10,5	371,9	300	0,044
		74	166	11,1	392,3	150	0,022
		75	167	11,7	413,5	0	

**Fix fan drive ratio 1:1,04**

Engine speed rpm	Engine power kW hp	Air on temp		Air flow		External restriction	
		°C	°F	m <sup>3</sup> /s	ft <sup>3</sup> /s	Pa	psi
1900	405	70	159	9,1	321,7	450	0,065
	551	71	160	9,6	338,3	300	0,044
		72	162	10,2	358,4	150	0,022
		73	164	10,7	377,2	0	

**Fix fan drive ratio 1:0,97**

Engine speed rpm	Engine power kW hp	Air on temp		Air flow		External restriction	
		°C	°F	m <sup>3</sup> /s	ft <sup>3</sup> /s	Pa	psi
1900	405	69	157	8,4	297,7	450	0,065
	551	70	158	8,8	312,2	300	0,044
		71	159	9,4	331,3	150	0,022
		71	160	9,8	346,8	0	

**Fix fan drive ratio 1:0,88**

Engine speed rpm	Engine power kW hp	Air on temp		Air flow		External restriction	
		°C	°F	m <sup>3</sup> /s	ft <sup>3</sup> /s	Pa	psi
1900	405	67	153	7,6	269,5	450	0,065
	551	68	154	8,0	281,5	300	0,044
		69	156	8,5	298,8	150	0,022
		70	157	8,8	310,4	0	

**Cooling performance: STD cooling package 1,42m<sup>2</sup> radiator and pusher 890mm electronically controlled visco fan**

Cooling air flow and maximum additional external restriction at different radiator air temperatures based on 107°C TTT and 40% coolant. Valid at 1 atm.

**Visco fan drive, pully ratio 1:0,88**

Engine speed rpm	Engine power kW hp	Air on temp		Air flow		External restriction	
		°C	°F	m <sup>3</sup> /s	ft <sup>3</sup> /s	Pa	psi
1900	405	67	152	7,5	263,1	450	0,065
	551	67	153	7,8	274,4	300	0,044
		69	155	8,2	290,6	150	0,022
		69	157	8,5	300,9	0	

**Cooling performance: HD cooling package 0,87m<sup>2</sup> radiator and pusher 890mm fan**

Cooling air flow and maximum additional external restriction at different radiator air temperatures based on 107°C TTT and 40% coolant. Valid at 1 atm.

**Fix fan drive ratio 1:0,88**

Engine speed rpm	Engine power kW hp	Air on temp		Air flow		External restriction	
		°C	°F	m <sup>3</sup> /s	ft <sup>3</sup> /s	Pa	psi
1900	405	64	147	8,9	315,7	400	0,058
	551	66	150	9,4	332,9	300	0,044
		67	153	10,0	352,7	200	0,029
		69	156	10,6	372,7	100	0,015
		71	159	11,2	397,1	0	

**Cooling performance: HD cooling package 0,87m<sup>2</sup> radiator and suction 890mm fan**

Cooling air flow and maximum additional external restriction at different radiator air temperatures based on 107°C TTT and 40% coolant. Valid at 1 atm.

**Fix fan drive ratio 1:0,88**

Engine speed rpm	Engine power kW hp	Air on temp		Air flow		External restriction	
		°C	°F	m <sup>3</sup> /s	ft <sup>3</sup> /s	Pa	psi
1900	405	61	142	8,4	295,5	400	0,058
	551	63	146	8,9	314,5	300	0,044
		65	149	9,3	329,8	200	0,029
		67	152	9,8	346,6	100	0,015
		68	154	10,3	364,1	0	

**Engine management system**

Functionality	Alternatives			Default setting
Governor mode	Droop	Isochronous		Isochronous
Governor droop	10	127	Nm/rpm	
Governor response	Adjustable PI constants			
Idle speed	600	900	rpm	700
Preheating function	Ignition	Request	Request + temp	If preheat is available, preheat will be active at ignition on if temp low or demanded by driver.
Ignition off stops engine	Yes	No		No

Engine sensors and switch settings		Engine protection action			
Parameter	Unit	Warning setting (Yellow)	Alarm setting	Default	Optional (Module or)
Oil temp	°C	125	130	Derate	Shut down.
Oil pressure	Low idle	80	55,0	Shut down	Shut down.
	Rated speed	300	275	Shut down	Shut down.
Oil level		Low level	N/A	Fault code only	Fault code only
Piston cooling pressure >1000 rpm	kPa	Not available on this engine			
Coolant temp	°C	105	107	Derate	Shut down.
Coolant level		N/A	Low level	Derate	Shut down.
Fuel feed pressure	Low idle	See Fuel pressure limits	N/A	Fault code only	Fault code only
	Rated speed		N/A	Fault code only	Fault code only
Water in fuel		Alarm when closed	N/A	Fault code only	Fault code only
EGR temp	°C	N/A	N/A	N/A	N/A
Air filter pressure drop	kPa	5	N/A	Fault code only	Fault code only
Altitude, above sea	m	N/A	N/A	Automatic derating, see section derating	Automatic derating, see section derating
Crank case pressure		N/A	Alarm at high peaks	Shut down	Shut down.
Charge air temp	°C	120	125	Derate	Shut down.
Charge air pressure	kPa	See Charge air pressure limits		Derate	Shut down.
SCR temp	°C	N/A	N/A	Automatic derating	Automatic derating
Engine overspeed	rpm	2400	N/A	Fault code only	Fault code only

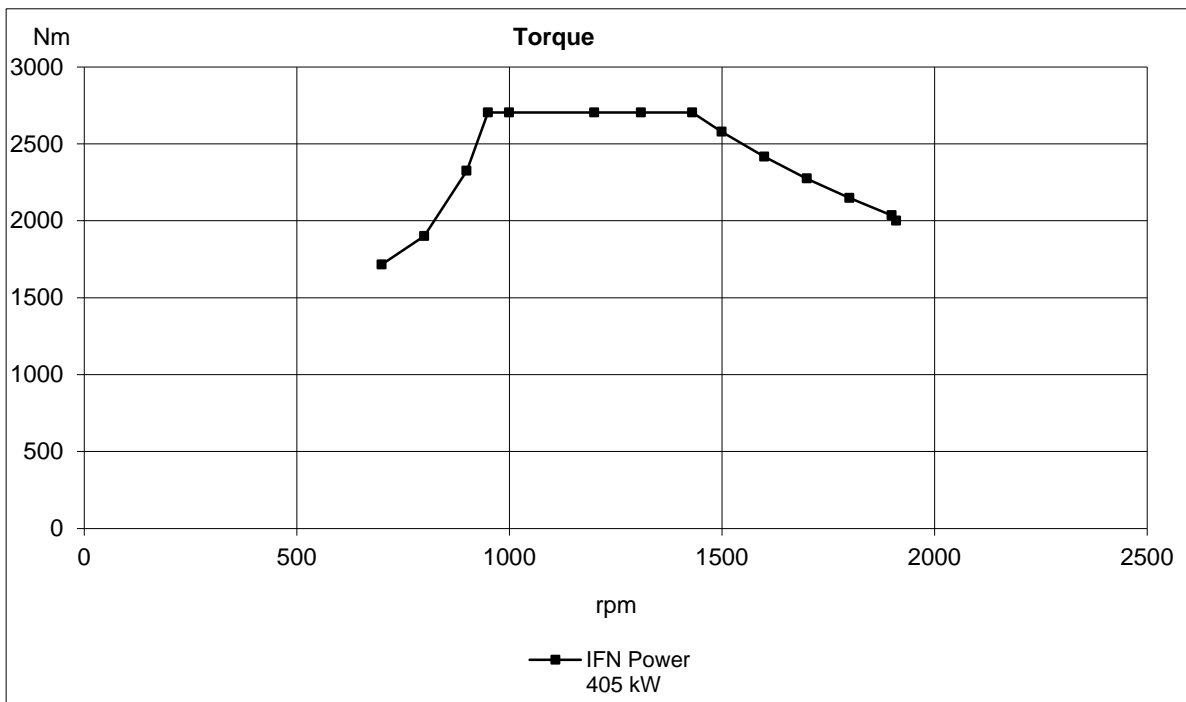
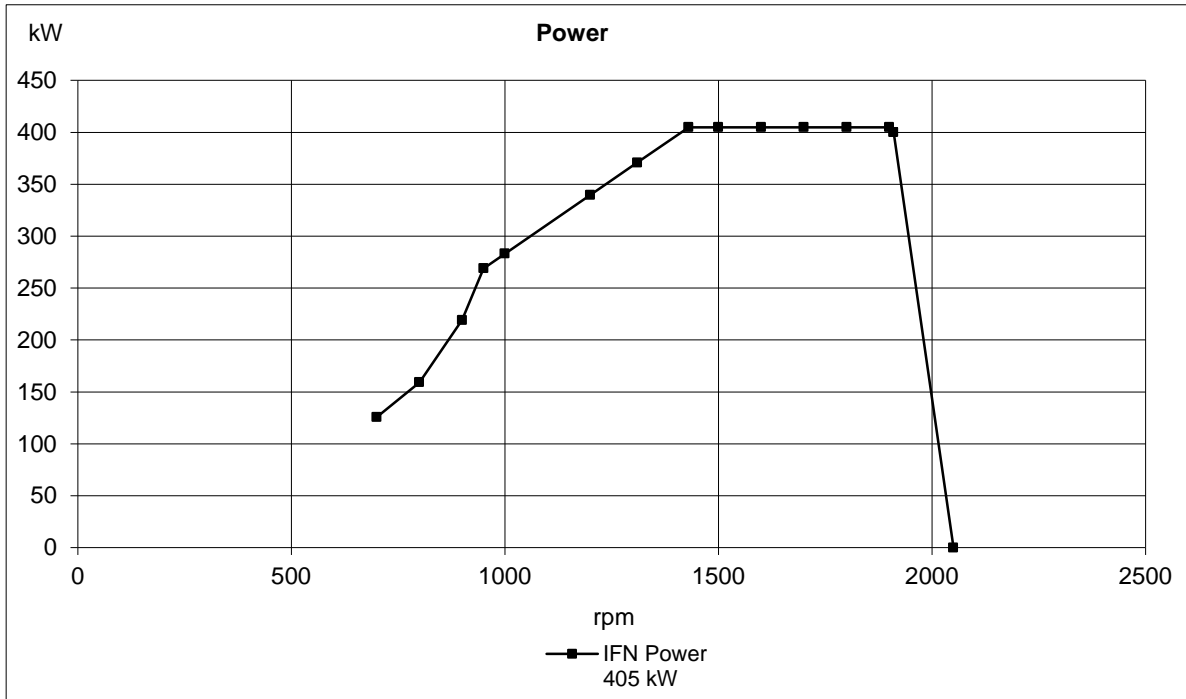
Derate parameters	Derated 0% to engine protection map	Derated 100% to engine protection map	Forced idle after 5 sec	Forced shut down after 0 sec
Oil temp	130°C	132°C	N/A	N/A
Coolant temp	107°C	108°C	N/A	N/A
Charge air temp	125°C	126°C	N/A	N/A
EGR temp	N/A	N/A	N/A	N/A
Low oil pressure	See Oil pressure limits		N/A	At alarm
Charge air pressure	See Charge air pressure limits		N/A	N/A

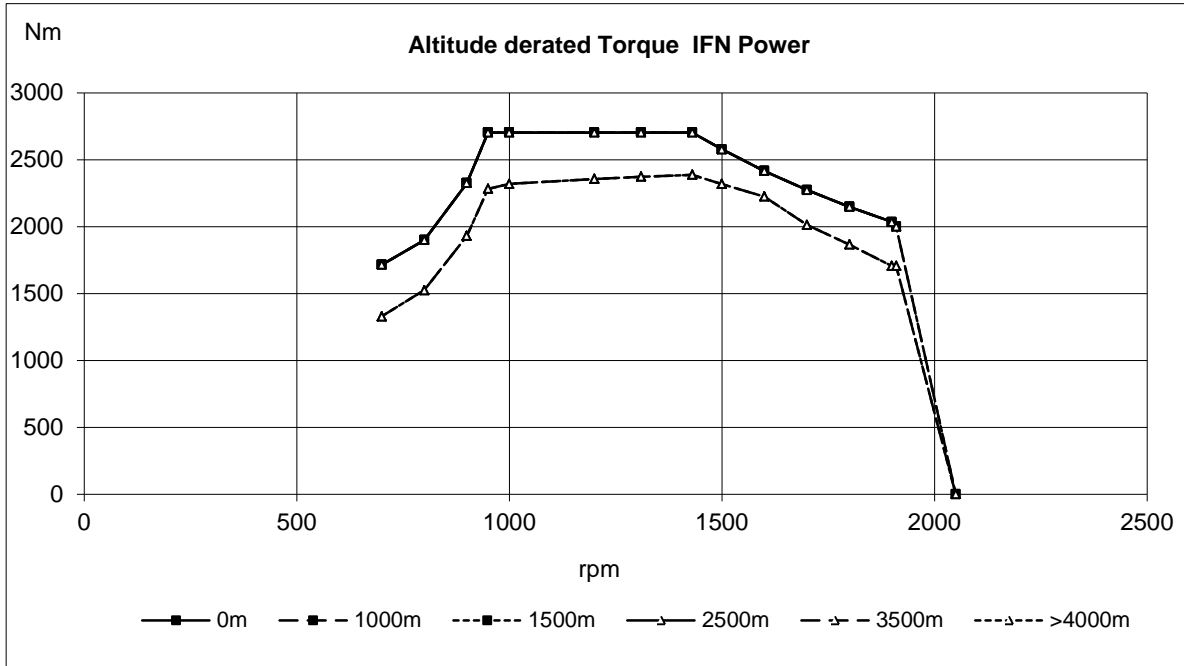
**Electrical system**

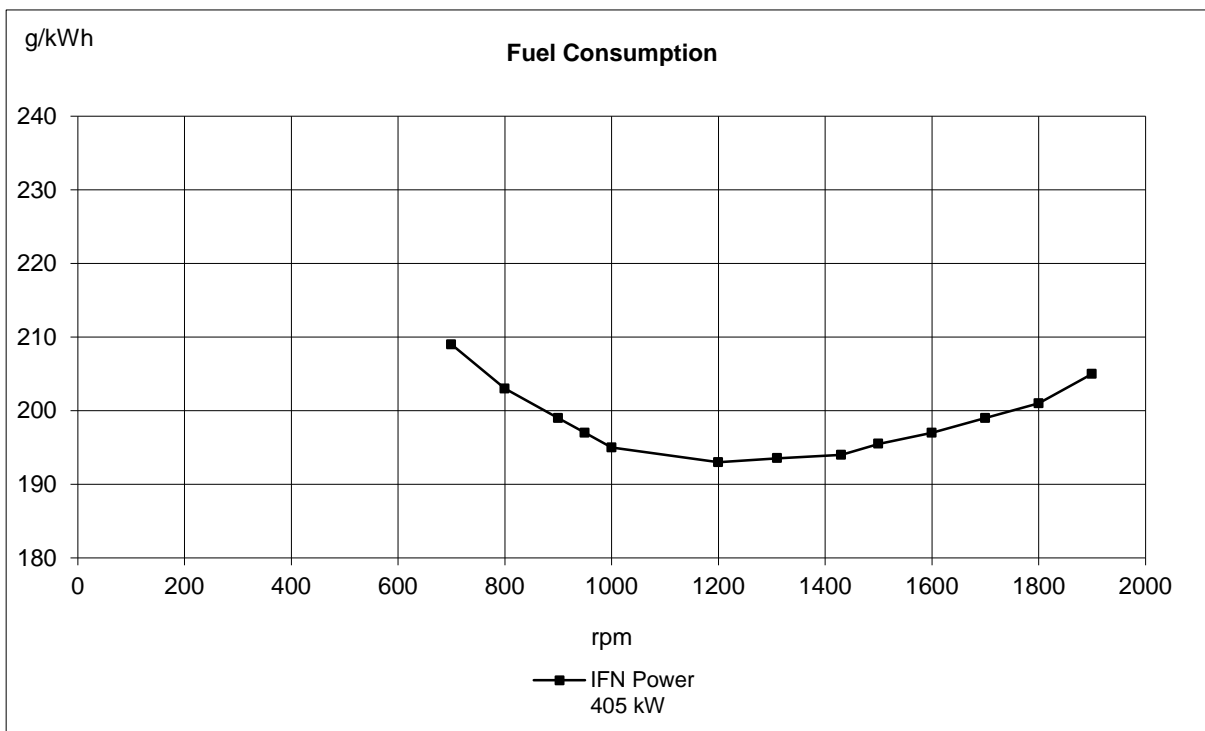
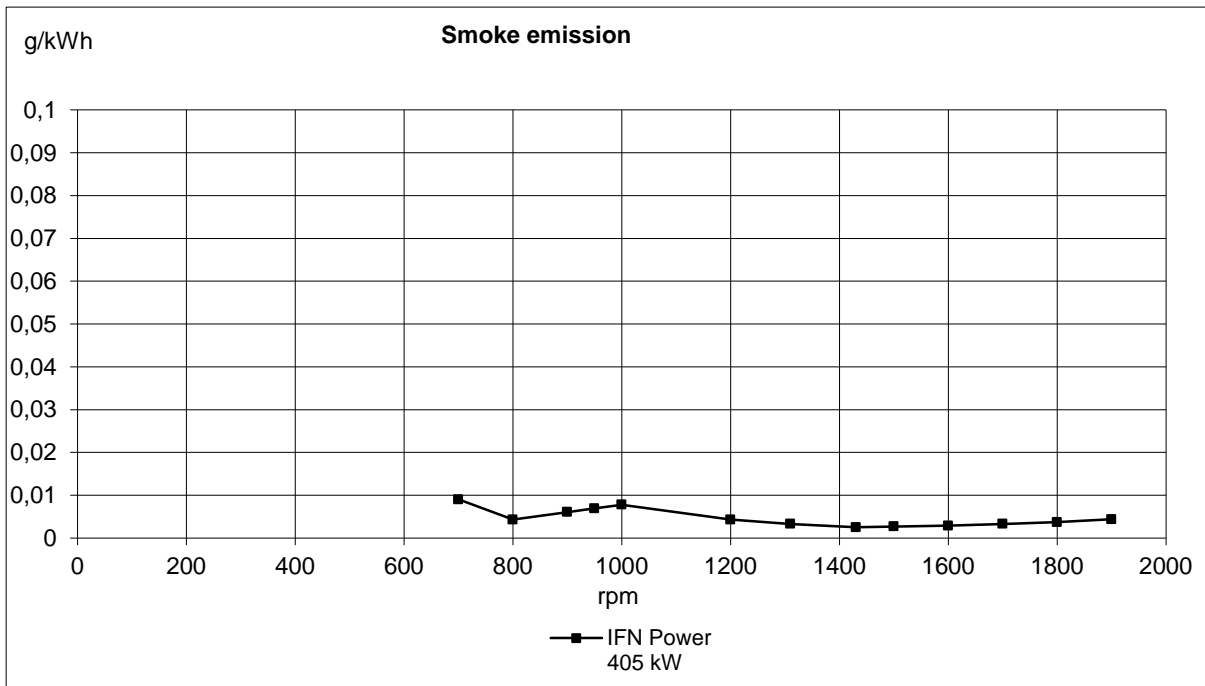
Voltage and type				24V		
Alternator:	make			Bosch		
	output	A		110/150		
	tacho output	Hz/alternator rev.		6		
	drive ratio			3,9:1		
Starter motor:	make			Melco		
	type			105P70		
	output	kW		7		
		hp		9,5		
Number of teeth on:	flywheel			153		
	starter motor			12		
Inlet manifold heater (at 20 V)		kW		2		
Power relay for the manifold heater		A		1		
<b>Conditions:</b>						
(4,2 mΩ main circuit resistance@ 20°C)	<b>Temperature</b>	°C		<b>0</b>	<b>-15</b>	<b>-25</b>
	<b>Battery</b>	<b>Ah / CCA</b>		<b>185/1150</b>	<b>185/1150</b>	<b>185/1150</b>
Crank speed		rpm		124	101	81
Crank current		A		435	562	686
Starter input power during crank		kW				
Battery power during crank		kW				
Min battery @ 0°C		Ah / CCA		<b>140/800</b>	<b>140/900</b>	<b>185/1150</b>

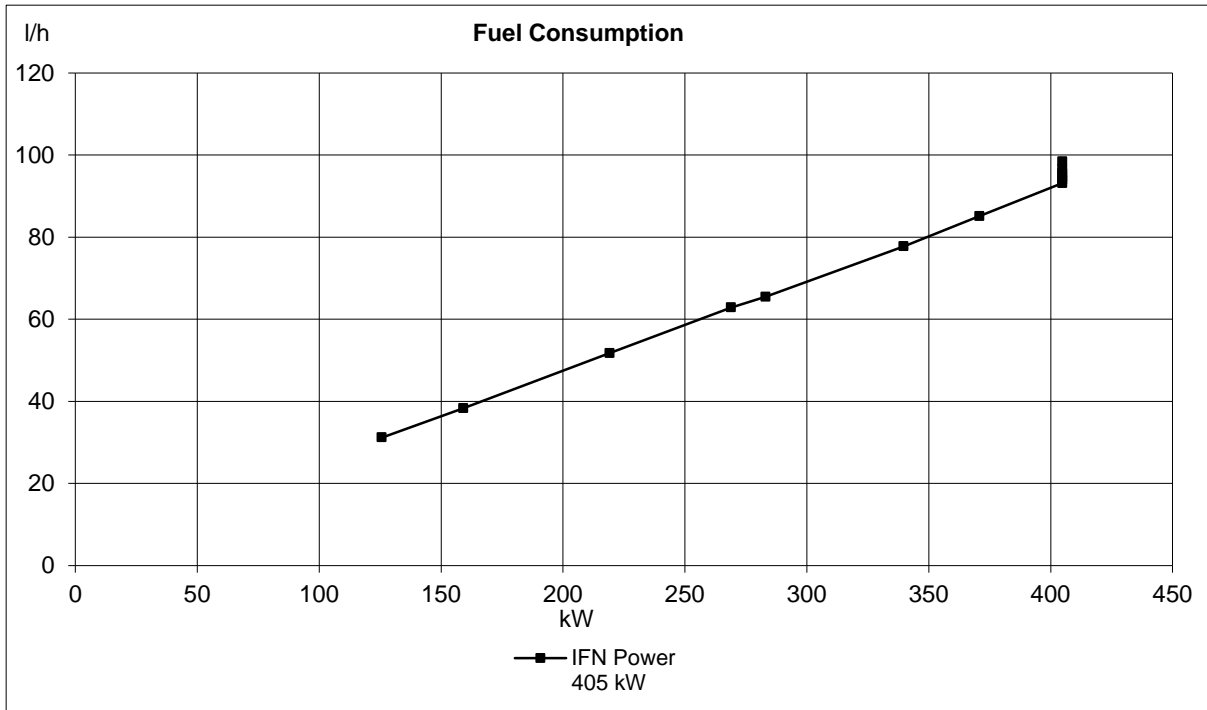
**Power take off**

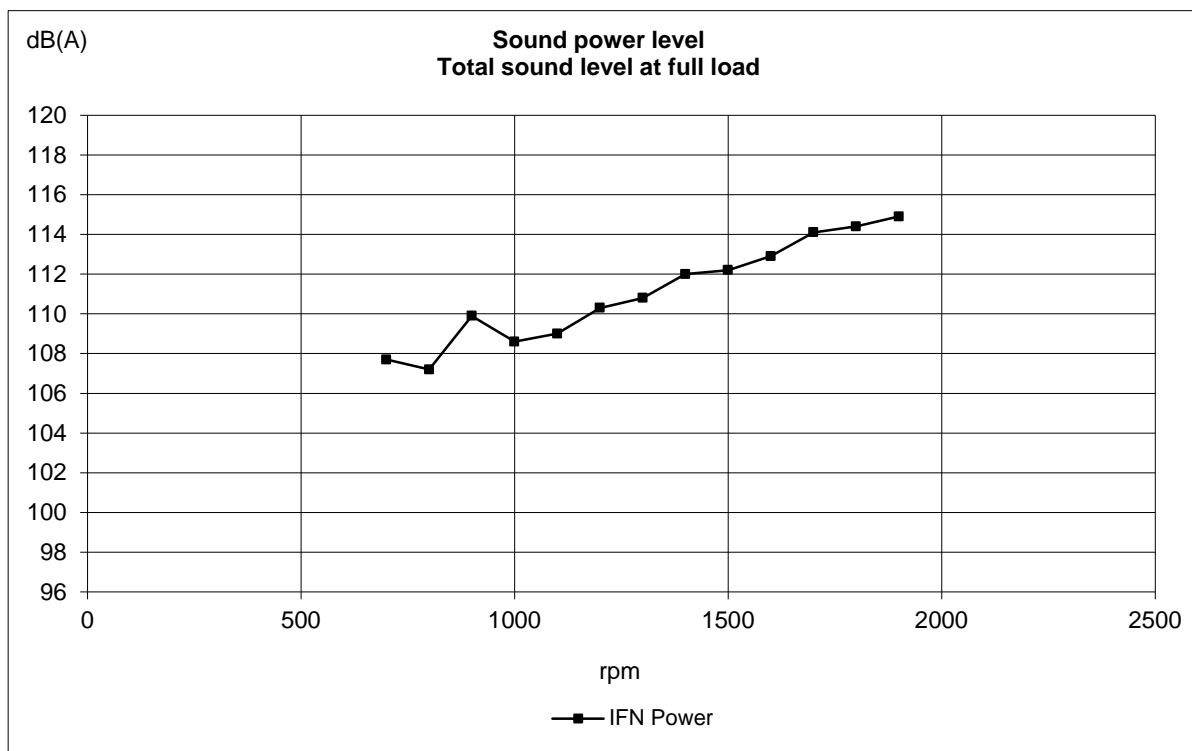
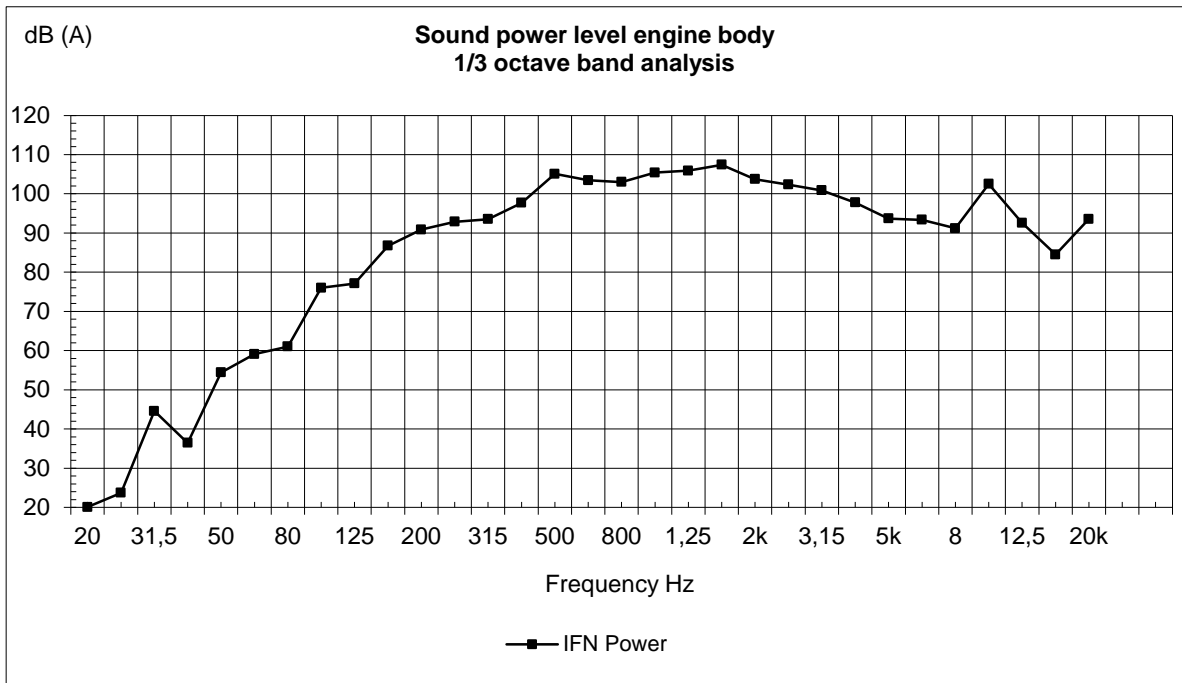
		rpm	1200	1500	1800	1900
Front end belt pulley load. Direction of load viewed from flywheel side:	max left	kW	26	33	40	
		hp	35	45	54	
	max down	kW	60	75	90	
		hp	82	102	122	
	max right	kW	26	33	40	
		hp	35	45	54	
Timing gear at compressor PTO max:		Nm lbf ft	300 221			
Speed ratio direction of rotation viewed from flywheel side		1,31:1 / ccw				
Timing gear at servo pump max:		Nm lbf ft	100 74			
Speed ratio direction of rotation viewed from flywheel side		1,75:1 / ccw				
Max allowed bending moment in flywheel housing		Nm lbf ft	15000 11063			
Max. rear main bearing load		N lbf	5000 1124,0			

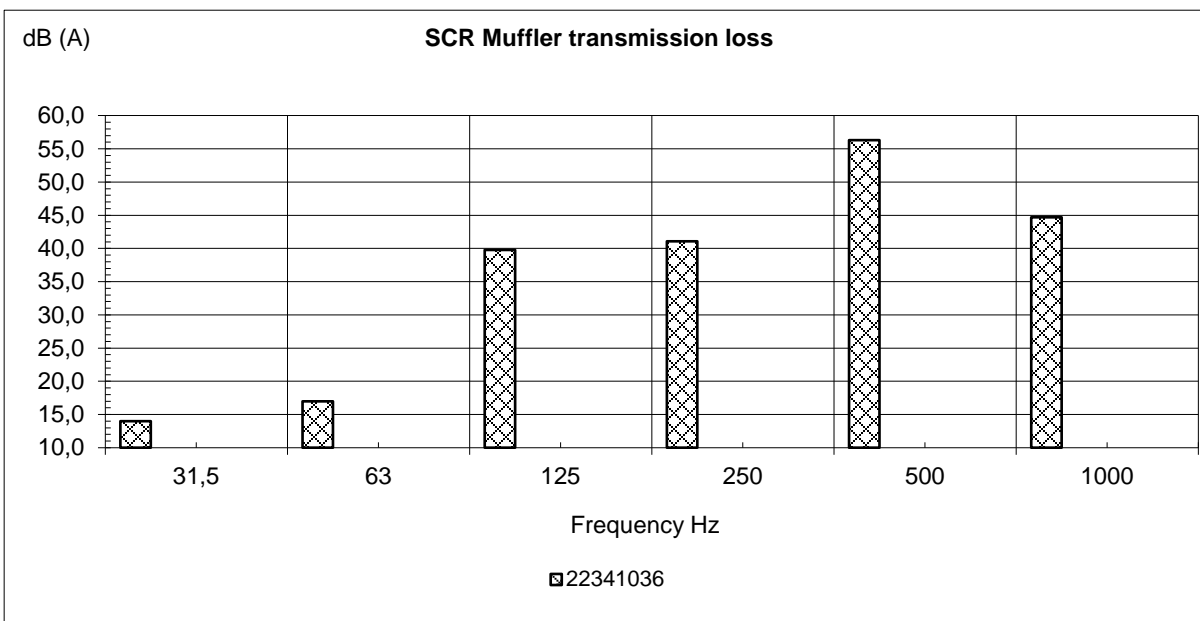
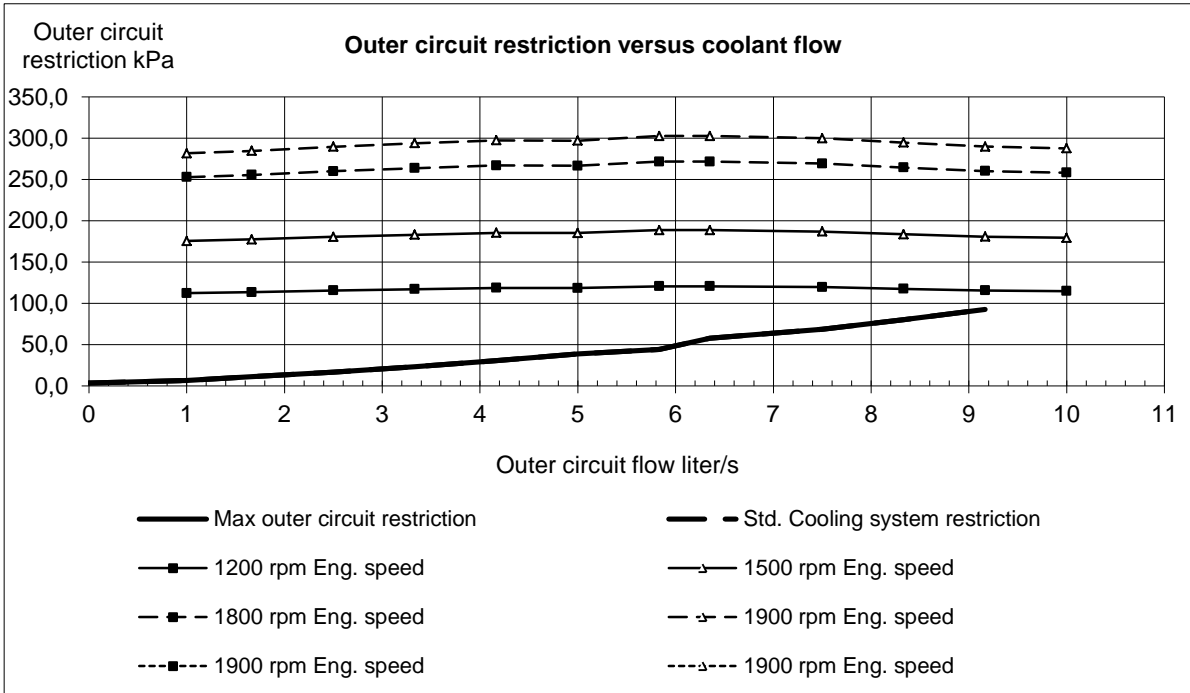




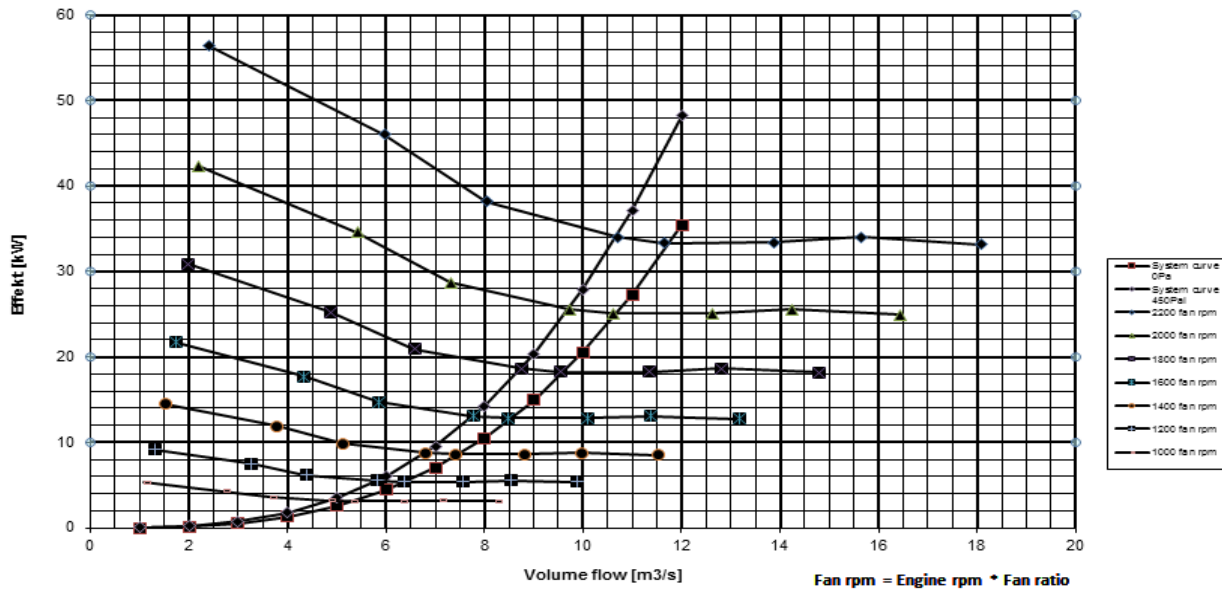




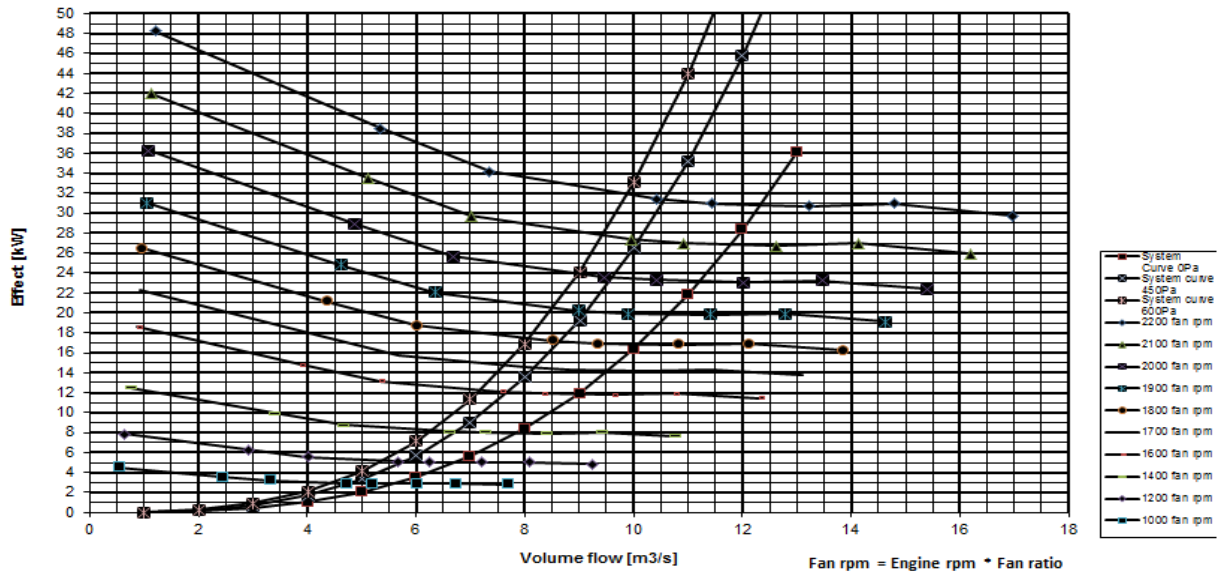




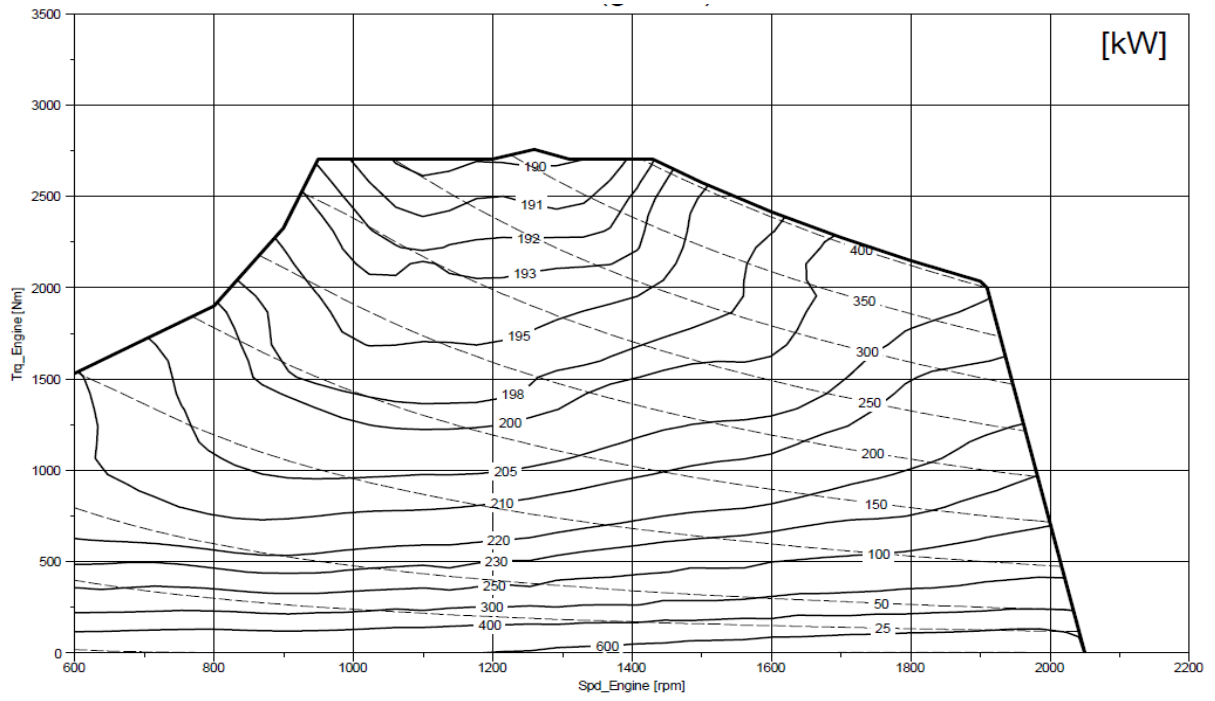
Fan power 890mm Pusher fan



Fan power 890mm Puller fan



BSFC [g/kWh]



Fuel consumption [l/h]

